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NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the space program.

Field Effect Transistors Used as Voltage-Controlled Resistors

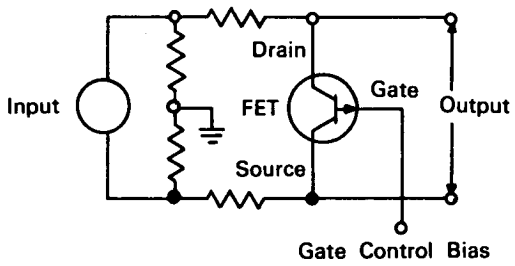

FIGURE 1

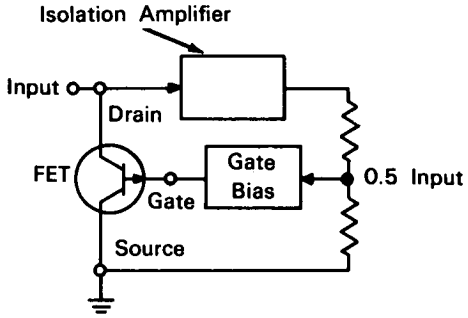

FIGURE 2

The problem: With small values of drain voltage, a field effect transistor (FET) behaves as a voltage-controlled, bipolar variable resistor. However, its resistance exhibits a considerable degree of nonlinearity for anything but the smallest voltages.

The solution: Two new circuits. Circuit 1 maintains the midpoint of the FET in the region of the gate at approximately ground potential over a wide control-voltage range. Circuit 2 cancels bias change due to any change of internal current-resistance drop.

How it's done: In Figure 1, the FET is operated in a balanced circuit with the control voltage applied to the drain connection and the inverse of the control voltage applied to the source connection. This results in a condition, at the midpoint of the FET in the region of the gate, of virtual ground potential. The result is linear response of the FET over a wider range of control-voltage levels. In the circuit shown in Figure 2, one-half of the control voltage appearing at the drain connection is capacitively coupled to the gate, thus cancelling the bias change that would otherwise result from a change of internal current resistance drop. This method results in linear response of the FET over a wider range of control-voltage levels than does the method previously outlined. The isolation amplifier may be removed from the circuit but maximum circuit resistance will then be limited by the sum of the resistors in the divider network.

Notes:

1. These circuits would be useful in a variety of control and monitoring applications, for example, audio and video AGC stages and bias drift monitors in precision input/output equipment such as analog-to-digital converters.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Marshall Space Flight Center
   Huntsville, Alabama, 35812
   Reference: B64-10163

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C., 20546.

Source: International Business Machines Corp. under contract to Marshall Space Flight Center (M-FS-174)

Category No. 01